DOCUMENT RESUME

ED 144 676 PS 009 390

AUTHOR Bronson, Wanda C.; Pankey, William B.
TITLE The Evolution of Early Individual Differences in Orientation Towards Peers.
SPONS AGENCY National Inst. of Mental Health (DHEW), Rockville, Md.
PUB DATE Mar 77
GRANT NIMH-MH-17312-07
NOTE 16p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (New Orleans, Louisiana, March 17-20, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Data Analysis; *Developmental Stages; Individual Differences; *Infants; *Measurement Techniques; Observation; *Peer Relationship; Research Methodology; Social Behavior; Social Development; *Social Relations

ABSTRACT

The research described is based on videotapes of 40 toddlers interacting with peers during 10 small playgroup sessions spaced throughout the children's second year of life. The paper outlines the development of an observational system for studying the development of peer relations in toddlers, considers the behavioral forms which characterize peer directed behavior at different periods within the second year and examines coherence over time among these forms. Also touched on are the issues of individual differences and their stability. (JMB)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED144676

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

THE EVOLUTION OF EARLY INDIVIDUAL DIFFERENCES IN ORIENTATION TOWARDS PEERS[1]

Wanda C. Bronson and William B. Pankey

As is true in most instances of early development, one sees in peer behavior a situation in which the repertoire of behavioral expressions, the latent psychological mechanisms which generate these behaviors, and the salience that such mechanisms may attain for different individuals are all concurrently undergoing some form of development.

Let me expand briefly. A sense of change or of shifts in the behavioral repertoire becomes evident in watching groups of toddlers at successive stages of the second year: although much of what transpires among them persists in being hard to characterize as to intent, a different prevalence of different patterns of peer directed behavior at different ages attests to a pervasive change in the overall qualities of expression. Further, since it has been amply demonstrated in studies of behavior with mother and with other adults that the emergence of new cognitive capacities conditions the development of early social behavior, it seems necessary to assume that the very concept of "peer and his functions" will be mediated by mechanisms which are in some sense different for the 12 month, and for the 24 month old toddler. And finally, differences in rates of maturation, in temperamental dispositions, in kinds of life experiences will necessarily combine to effect individual variations in sensitivity to the operations of different mechanisms at different developmental stages.

While the sources of change are self evident, a presupposition of "developmental coherence" nevertheless implies the presence of some lawful regulatory principles. We suggest that empirical attempts at detecting the operations of such principles must at the least start by meeting two broad requirements: a) the inclusion of attempts at explicit representation of options for more than one form of regularity, and b) examination of the consequences that endorsement of any one particular regulatory mechanism has for all parts of the system which is being considered.

This programmatic statement is obviously far easier to make than to implement. Though we are not far beyond the initial stages of attempts to implement what we preach we can at least provide here some concrete examples of the strategy we are pursuing so as to clarify its implications. We shall start by outlining the schema used for generating data; consider next the behavioral forms by which we currently characterize peer directed behavior at different periods within the second year; briefly examine the question of their coherence overtime, and finally just touch on issues of individual differences and their stability.

---

1 Read at the meetings of the Society for Research in Child Development, March, 1977, New Orleans, Louisiana, in the context of a symposium on "The organization of development and the problem of continuity in adaptation." The work is being supported under NIMH grant MH 17312 07. We are pleased to gratefully acknowledge Susan Swanson's essential contribution in generating and organizing this material for study. Both authors' address: Institute of Human Development, Tolman Hall, University of California, Berkeley, California 94720.

PS 009390

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Wanda C. Bronson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

Derivation of a method of assessment

The original material consisted of videotaped records of the activities of 40 toddlers, each of whom (accompanied by the mother) participated in a series of 10 small playgroup sessions spaced throughout his second year. Each playgroup involved 3 or 4 mother-child pairs who were generally unacquainted at the outset of each session. The playgroup atmosphere was characteristically relaxed and informal: the mothers usually chatted with one another during the close to one-hour period leaving their children free to engage with the supply of toys, each other, cookies and juice, or mother--just as they wished.

The primary decision we had to make concerned which facet of what babies do with each other could best serve the substantive interest of our research. Given that the situation involves participants of equal volatility, who share no past history of association, and whose skills for sustaining social interchange are as yet both limited and strongly dependent on the support of the other it seemed unlikely that focus on transactional phenomena could generate much unambiguous or productive information: emphasis on peer directed behavior conceived as an individual's reaction to a class of objects which is controlled by factors external to the immediate situation appeared to hold more promise. While it is incontrovertible that a design which would incorporate an empirical test of the validity of this formulation is the only truly appropriate option, our limited capacity to deal with complexity led us to provisionally limit the generality of the study and elect to characterize each toddler solely by the acts he chose to initiate to his agemates.2

An exhaustive and behaviorally specific coding system was developed in the course of many preliminary viewings and applied to 40 consecutive minutes of each of the 104 playgroup records. Every time any of the participating toddlers directed anything beyond mere visual attention to any of his peers the nature of his communication was specified by a set of explicit codes, each descriptive of five concurrent sources of variation: 1) kind of signal gesture; 2) direction of visual regard; 3) vocal/verbal behaviors; 4) indices of affect, and 5) contextual factors.

A wide variety of behavioral patterns which differ to a greater or lesser extent along one or more of these domains of variation was generated by this method. Conceptual clarity, sample size, and the overall low frequency of initiations to peers (an average of only about 10 instances per toddler per 40 minutes) required imposition of a stronger structure. As a first step, initiations in sets of 3 or 4 consecutive playsessions were combined to reflect a toddler's overall Trimester-by-Trimester peer directed

---

2 This is not the place to argue the merits of the theoretical bias which is being expressed: referencetoM. Konner's "Relations among infants and juveniles in comparative perspective" in M. Lewis and L. Rosenblum (eds.) Friendships and Peer Relations, Wiley, 1975; K. Garvey's Play, Harvard University Press, 1977, and J. Dunn's "How far do early differences in mother-child relations affect later development?" in P.P.G. Bateson and R. A. Hinde (eds.) Growing Points in Ethology, Cambridge University Press, 1976, will indicate some sources of its origin. Though in no way can it serve as empirical support of our assumptions, the reader may nevertheless be interested to know that normative survey of the data indicates that the repertoire of toddlers' behaviors in response to agemates approaches in our playgroup situation is remarkably narrow and invariant while behaviors used in initiating an encounter show both wide individual differences and significant patterns of developmental change.

behavior. And secondly, a classificatory system which equivalenced differing kinds of patterns into a limited set of distinct "types of initiations" was imposed upon the first order data. The nature of these types and how they were generated are roughly illustrated in Handout #1, which also shows the frequencies of each type as observed in consecutive Trimesters. I cannot go here into the many specific rules of coding and rationales of classifications; but you will want to know that the reliability of this system, assessed by agreement between independent videotape coders (on a pool of about 400 incidents sampled from portions of different sessions) ranges between 66 and 100% depending on initiation type, with a satisfactory overall mean of 89% concordance.

The different "types of initiations" listed in the handout were subsequently integrated to reflect three conceptual perspectives from which to consider peer behavior. The motivation for imposition of such further rational structure should be clear. On practical grounds: it is evident that the low incidence of many of the specific "initiation types" would make attempts at systematic study at this level of detail a very chancy affair. And on conceptual grounds: to yield results both strong and comprehensible, our search for coherence within a morass of theoretical unknowns had to look for an optimal level of balance between conceptual simplicity and articulation.

Our "best bet" as to how such an optimal balance might be achieved with our data is shown in the three organizational schemas represented on the left side of Handout #2. We shall focus discussion only on the Overall schema (printed in the larger type) which categorizes all types of initiations; the other two--one of which focuses on only agonistic initiations, and the other on structuring solely prosocial behavior--are included merely to indicate the full scope of analyses which is actually underway. Within each schema, the 3 category-sums parse out the toddler's relevant initiations into a single profile to describe the quality of his overall, his agonistic, and his prosocial style of behaving to peers.

Such was the sequence of essentially simplifying assumptions which brought us to the point of stating the descriptive system. These decisions have the advantage of being public and explicit; their weakness lies in being based on rational rather than empirical grounds. There has been a loss of detail and thereby of richness--in return, we gain data from which it will be possible to make some strong empirical claims.

Establishing age specific forms of behavioral expression

The schematic representation on the right hand portion of the Handout is intended to help you visualize those data and their analysis. At each Trimester, 40 individual profiles spell out the range of variation in behavioral styles (as conceptualized within a particular schema). The task is to specify from this pool a reduced set of "prototype configurations"--"prototype" in the sense that they could demonstrably be shown as sufficient to represent the variability of the observed data. Our model for this analysis was derived

from the family of so-called "latent structure" models.[3] In essence: a sequence of solutions is fitted to the data, with each solution estimating a successively larger number of prototype configurations (two, three, four). The matrix of residuals in each solution, and the difference in chi-square values relative to the difference in number of parameters estimated in successive solutions provide guidance for determining when further increase in number of configurations (that is, addition of complexity) fails to be justified by considerations of the goodness of fit. As a consequence, we have reasonable grounds for confidence in the productiveness of focusing on the number of prototypes that we did accept. A second essential point to note is that in these applications the model is identified: concerns such as arise from the rotational indeterminacy of most factor analytic models are eliminated, allowing us confidence in the specific characterizations which distinguish the configurations.

The top portion of Handout #3 shows what configurations were actually obtained within the Overall organizational schema. Consider first what a cross-sectional view to which this sequence of three sets of profiles lends itself has to suggest about second year peer behavior. The first profile, labeled "Agonistic " simply because its configuration shows a very high proportion of the agonistic category of behaviors, is the most consistent of all appearing as a form specific to each of the three separate ages. However, its prevalence (note the estimates entered under each profile) differs markedly overtime: unusual at the outset, this markedly negative form of behavior to peers becomes modal in the second Trimester only to decrease again to a lower level at the end of the year. The configuration labeled "Prosocial"--predominantly positive and hence a near mirror-image of the "Agonistic" profile--appears from this cross-sectional perspective as a form which disintegrates with time: relatively prevalent at the beginning, it is quite rare at the second Trimester and fails to emerge at all in the final period. The opposite phenomenon--that of an emergent form--is implied by the "Bimodal" configuration: marked by concurrently high proportions of both "Agonistic" and "Prosocial" behaviors, it emerges only in the middle of the year and in the following period. And finally, the "Neutral" configuration: labeled as such more by default than by conviction, reflecting a higher proportion of the quasi-social "Investigatory" category than any of the other prototypes, it is the modal form of Trimester I, fails to emerge from the second Trimester analyses, but obtains once again as quite

---

3 The description which follows in the text provides no more than a loose notion of what is involved; readers wishinga more informative view should consider that our approach to the anlysis of the pool of response vectors assumes that the probabilistic nature of such sequences may naturally be described by some parameterization of Haberman's (Haberman, S. J. (1974) The Analysis of Frequency Data, Chicago: University of Chicago Press) generalized Poisson sampling scheme. Under particular model specifications such sample behavior is then described in terms of a finite mixture of certain generalized Poisson distribution functions. In this special instance, the sampling scheme reduces to a product multinomial over individuals, the mixed distributions to point multinomial distributions, and the mixing distribution to a multinomial. The "prototype configurations" are to be understood as these mixed distributions. The analysis proceeds by investigating the empirical implications of increasing orders of this mixing distribution. The goodness of fit of these differing models is described by the residuals associated with each subject behavior and summarized by large sample chi-square statistics. The model fitting process terminates when increasing orders of complexity describe little more "significant" information as gauged by such measure of fit. (Readers who wish more particulars are invited to write to Bill Pankey).

prevalent at the end of the year.

The visual similarity which marks these configurations in successive sets of profiles strongly suggests a sense of some coherent developmental flow. Since the data are longitudinal (it is the behavior of the same toddlers which is being characterized throughout the year) we can look to the joint probabilities of one configuration being linked with another to examine first the theoretically simplest formulation of "stability:" a position which states that similarity in behavioral expression at different ages indicates presence of but a single common latent mechanism.

Examination of coherence among behavioral forms

Four such "straight stability" hypotheses are logical for the set of configurations we have been discussing--you see them listed as the first group in the middle portion of the Handout. Each of these 4 to-be-examined models constrains the total number of possible overtime sequences by specifying some to be impossible. The most general alternative to each of these is a model which places no constraints of theoretically impossible sequences whatsoever. Estimates of the probabilities of all configurational sequences were generated under each model. Must the general alternative be entertained in favor of the models which place particular sets of rational constraints on the full range of possibilities? The same statistical measure of "relative goodness of fit" we used before (comparison of the difference in chi square values associated with the competing models, relative to the number of parameters being estimated by each) obtains here. The message of these estimates is pretty clear: it is only the stability of the late emerging "Bimodal" configuration that cannot be rejected in favor of the more general alternative.

Is then the vision of a "coherent developmental flow" of which I spoke merely an illusion? Not if we broaden the view of developmental process from "straight stability" to "coherence." In the bottom section of Handout #3 you see a list of successively ordered statements, each postulating an increasing complexity of non-chance relationships among the behavioral forms. Examining the comparative likelihood of each of these models we see that the hypothesis of no developmental coherence (the simplest and therefore strongest model) cannot be entertained in favor of the added complexity of postulating non-chance relationships between adjacent ages (H 2) since the latter significantly increases the goodness of fit to the data. In a similar fashion, a model which postulates the further complexity of coherence among behavioral forms within the whole year (H 3) is to be favored over H 2. However, postulating that additional interactive effects are inherent in 3rd order probabilities (H 4) does not generate any significant improvement of fit: parsimony dictates that this increase in complexity not be necessarily considered. We accepted the model we could not reject as providing the most plausible formulation: there is a developmental phenomenon to be explained--though similar configurations of behavior are likely to be generated by operations of different mechanisms at different ages, the transitions among successive forms are under the control of some common latent structures.

To help me transmit a feel for the nature of the conceptual task which now lies ahead I ask you to glance at Slide 1 which presents the estimates of

how strong a statement can be made about a toddler's behavior in a later Trimester given the knowledge about his earlier behavior; the shading and circling of entries points to where statements of considerable strength are being implied under the assumptions of the model we are considering at this particular time. Even under conditions of a cursory glance it is evident that a rich source of speculation is being suggested here. Welcome avenues for thought and intuition are opened up--but so are vast opportunities for post hoc theorizing based on isolated segments of the system which is being portrayed.

We suggest that two choices lie ahead: both serve to constrain untrammeled speculation but, though not incompatible as concurrent facets of a research strategy, will have a different eventual impact on theory construction. The first is to use information provided by analyses such as that which is reflected in the tables to derive contrasting hypotheses concerning the mechanisms which might generate the observed organization and, using means similar to those we demonstrated earlier, examine the plausibility of one relative to the other. The second follows from what I think the zoologist Richard Dawkins expressed so well in saying that any non-trivial model must be a "partially free invention which does not follow logically from known facts." It implies considering broad organizational and regulatory principles embodied in extant segments of developmental theories to construct and examine formulations which attempt to both integrate and transcend the particulars of the substantive issues under study. A call for a return to theory on a grand scale sits uneasily in the context of the current Zeitgeist and it certainly may prove to be well beyond our own intellectual capacities: nevertheless, it appears that entertaining the notion of "developmental coherence" demands that such attempts be at least seriously considered.

Coherence of successive developmental forms and stability of individual differences in their utilization

The last conceptual point we need to touch on relates to the distinction between coherence among successive behavioral forms, and the stability of individual differences in their utilization. The overtime coherence among discretely characterized age specific forms permits us to explore the plausibility of invoking different latent mechanisms as being involved in generating particular sequences of behavioral expressions. To characterize individuals, however, we seek to index differences in the salience that the mechanisms we postulate may be exerting on their behavior. If every individual were to behave exclusively under the control of but a single mechanism, the continuity of behavioral forms and that of individual differences would not, of course, be distinguishable. But since it seems psychologically far more likely that more than one mechanisms mediates a given toddler's approach to his peers, a characterization in terms of differences in proneness to favor one over another behavioral form should isolate the evolution of individual differences in propensities from investigation of any overtime coherence in the behavioral forms that such propensities assume.

We have not as yet completed development of the appropriate model to allow study of this conception of individual differences, but we can mention a speculative suggestion gained from the most preliminary of "look-see" analyses. "Proneness to a particular form" was indexed here by a transformation of the ratio of how much a given toddler uses a form, to that form's prevalence

in the whole sample at that period. Pearson correlations among these "proneness scores" are shown in slide 2; the speculation I mentioned arises from comparison of the two circled blocks which represent transitions between adjacent ages. The correlations defining Trimesters II to III transitions are overall substantially stronger than those marking Trimesters I to II development: this implication of a greater degree of common structure suggests that stability of individually different propensities may begin to emerge in the second half of the year.

To conclude, let me summarize where we think our strategy has brought us to date. With all the appropriate caveats about limitations imposed by the nature of the sample and observational methods, we can even now assert that the change in the form of behaviors directed to peers in the second year is regulated by developmental factors. Moreover, and most importantly, we believe we can be more precise in documenting the conditions for our confidence (and specifying its limits) than is often the case. Though we cannot as yet specify the nature of these factors we stand well equipped to attempt to do so and we can already strongly suggest that they are unlikely to be indexed by similar behaviors at different stages. We can show that there are marked individual differences in propensities to different modes of approaching peers and offer speculative evidence of coherence in their development. Though we can admittedly demonstrate no more than the initial and most exploratory stages of our strategy we can at least submit that the effort has not been in vain: the notion that an evolution of different orientations to peers is proceeding within the second year of life demonstrably stands as one which merits serious consideration.

TYPES OF INITIATION: characteristics of the behavioral patterns grouped into each type

	Gestures	Attempts at eye contact	Vocalizations	Affect	Context	Frequency: N incidents (N babies) Trimesters: I	II	III
INTENSE DISPUTES	Take, reach for peer's toy; offer-withdraw (once or more)	Varies	(Nearly always present: repeated, loud)	Cries, whines, screams; abrupt, strong movements.	Varies	41 (20)	88 (22)	128 (29)
MILD DISPUTES	As above	Varies	(If present: brief, mild)	Mildly protestive intona- frown, pucker	Varies	122 (31)	149 (29)	114 (29)
OBJECT ISSUES	As above	Varies	Absent	Neutral	Varies	187 (35)	117 (34)	71 (26)
PHYSICAL ASSAULTS	Hit, push, pull hair, bite	Varies	Absent or present	(If present: negative)	No issue of gain of toy is involved	33 (9)	27 (13)	45 (12)
STRONG PROTESTS	Absence of gesture	Present	"Mine," "No" in words or vocalizations	Angry, distressed, crying; strongly assertive, loud	Peer had not directed any behavior to B	5 (4)	11 (9)	31 (13)
MILD PROTESTS	As above	Present	"Mine," "No" in words or vocalizations	Mildly affirmed, no distress evidenced	As above	13 (8)	46 (15)	56 (21)
NEUTRAL: OBJECT	To peer's toy: point, touch, move to gaze at	Absent	Absent	Neutral. Gesture brief, en passant	Uninformative	219 (38)	170 (34)	180 (35)
NEUTRAL: PERSON	Touch peer's body or clothing	Minimal	Absent	Neutral. Gesture brief, en passant	Uninformative	80 (31)	17 (13)	14 (10)
VOCAL: UNSPECIFIC	None; or touch, point to peer's toy	Minimal	Uninflected vocalization	Neutral. Brief	Uninformative	44 (18)	17 (14)	15 (12)
GIVES	Offer, give, deposit toy; feed cookie	Present	Absent or unspecific	Neutral	Uninformative	154 (33)	87 (24)	34 (18)
SHOWS	Show toy, show toy as uses	Present	Absent or unspecific	Neutral	Uninformative	61 (28)	34 (21)	45 (20)
VOCAL: SPECIFIC	None; or show, touch, point to toy	Present	Names own or peer's toy to peer; "Whatzat?" "Hi"	Neutral	Varies	16 (14)	20 (11)	16 (8)
RESTITUTIVE OFFER	Give, offer, deposit	Present	Absent or present	Neutral	Toy object of recent dispute	5 (5)	3 (3)	10 (9)
FACILITATIVE OFFER	Give, offer, deposit toy or cookie	Present	Absent or present	Neutral	Peer dropped, trying to get, in "need" of object	7 (5)	12 (10)	25 (12)
Request "INSTRUMENTAL" Play	Reach to toy held by peer or in peer's reach Give, show, point to object, beckon	Present Present	Requesting vocalizations Inviting vocalizations	Sustained, repeated	Object in peer's field B is engaged with toy	10 (5)	26 (12)	26 (12)
JOINT PLAY	Period of engagement with same toy or activity	Present	Absent or unspecific	Neutral	Varies	20 (16)	8 (7)	14 (7)
WORK TOGETHER	Period of engagement with same toy or activity	Present	Absent or present	Neutral	Pacing contingent on peer's behavior; shared plan	4 (4)	8 (6)	19 (14)
"PERSONALIZED"	None; or offer, vocalize, point	Sustained	Uses peer's name; "here" or "want that?" as offers	Neutral	Varies; (or peer is in some distress)	21 (12)	29 (17)	28 (16)
AFFECTIONATE	Pat, kiss, embrace, or any gesture with positive affect	Present	Absent or present	Smiles; gentle gesture, warm intonation	Varies	23 (20)	35 (14)	55 (21)

ORGANIZATION OF SPECIFIC TYPES OF INITIATIONS INTO STYLES OF PEER DIRECTED BEHAVIORS

OVERALL: exhaustive of all initiations

1. Category "Agonistic" (containing a component which is in some sense negative) Sum of:
   - Intense disputes
   - Mild disputes
   - Object issues
   - Physical assaults
   - Strong protests
   - Mild protests

2. Category "Investigatory" (brief, en passant: an absence of identifiably negative or positive social components) Sum of:
   - Neutral: person
   - Neutral: object
   - Vocal unspecific

3. Category "Prosocial" (containing a component which is in some sense positive) Sum of:
   - Gives
   - Shows
   - Vocal specific
   - Restitutive offer
   - Facilitative offer
   - "Instrumental"
   - Joint Play
   - Work together
   - "Personalized"
   - Affectionate

AGONISTIC initiations only

A. Category "Intense" (initiations marked by a strong and direct negative affect) Sum of:
   - Intense disputes
   - Physical assaults

B. Category "Mild" (superficial issues of possession) Sum of:
   - Mild disputes
   - Object issues

C. Category "Vocal" (negative reactions of a potentially greater degree of socialization, wariness, or cognitive sophistication) Sum of:
   - Strong protests
   - Mild protests

PROSOCIAL initiations only

a. Category "Simple" (unadorned "sharing" gestures) Sum of:
   - Gives
   - Shows

b. Category "Personal" (inference that the toddler has some recognition of peer as someone with whom meaningful exchange is possible) Sum of:
   - Vocal specific
   - Restitutive offer
   - Facilitative offer
   - "Instrumental"
   - Joint play
   - Work together

c. Category "Friendly" (marked by warmth or concern) Sum of:
   - "Personalized"
   - Affectionate

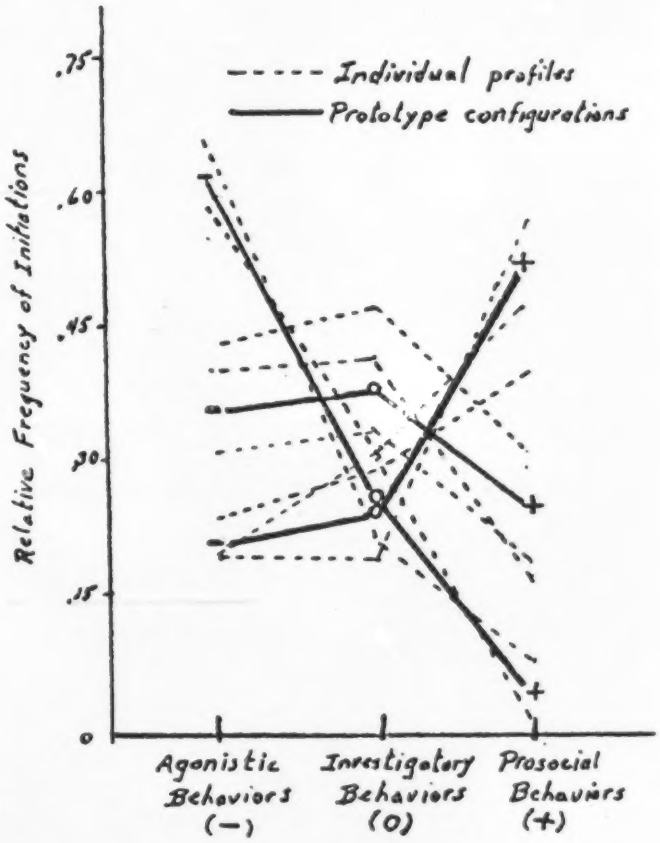
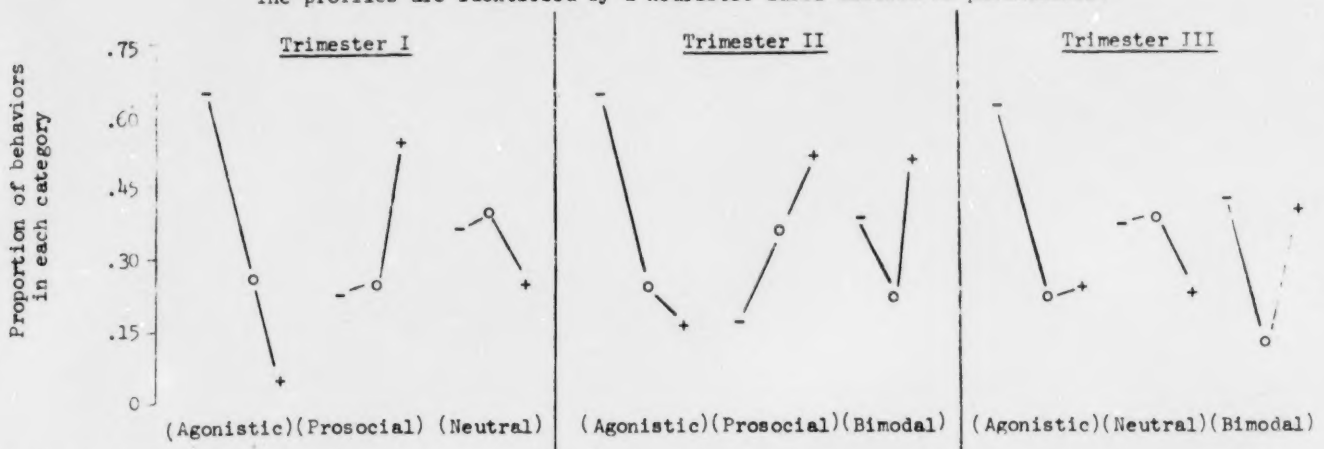


ILLUSTRATION OF THE ANALYTIC TASK

(Typical Trimester I data)

Successive behavioral forms of initiations to peers (as organized by categorizing all types of initiations as Agonistic (-), Investigatory (o), or Prosocial (+)). The profiles are identified by a heuristic label entered in parentheses.



Estimate of relative prevalence:									
	.15	.34	.51	.56	.15	.29	.31	.41	.28

EXAMINATION OF HIGHER ORDER STRUCTURE AMONG THE AGE-SPECIFIC BEHAVIORAL FORMS

Hypotheses of "straight stability" (forms with similar configurational characteristics are generated by the same mechanism at all Trimesters in which they emerge)

H a. "Agonistic" forms are so generated (Trimesters I, II, and III. Preclude any sequence in which the "Agonistic" form is not followed by itself)

H b. "Prosocial" forms are so generated (Trimesters I and II. Preclude any sequence in which the "Prosocial" form is not followed by itself)

H c. "Neutral" forms are so generated (Trimesters I and III. Preclude any sequence in which the "Neutral" form is not followed by itself)

H d. "Bimodal" forms are so generated (Trimesters II and III. Preclude any sequence in which the "Bimodal" form is not followed by itself)

General Alternative: there are no theoretical constraints on the probability of any overtime sequence

Relative goodness of fit

Accept General Alternative over H a : $p < .001$
Accept General Alternative over H b : $p < .001$
Accept General Alternative over H c : $p < .005$
(Do not) Accept General Alternative over H d : $p > .85$

Alternative hypotheses concerning coherence (increasingly strong statements about the extent of non-chance relationships)

H 1. All forms are only age specific (model of complete independence)

H 2. Relationship between forms of adjacent ages is non-chance (2nd order conditional probabilities: Tri I to II and Tri II to III)

H 3. Relationship among forms within the whole year is non-chance (2nd order conditional probabilities: Tri I to II, Tri II to III, and Tri I to III)

H 4. A non-chance interactive effect conditions the relationship among the forms within the whole year (both 2nd and 3rd order conditional probabilities among all Trimesters)

Relative goodness of fit (level of confidence for preferring the hypothesis of more structure over the one of less structure)

Accept H 2 over H 1 : $p < .05$
Accept H 3 over H 2 : $p < .005$
(Do not) Accept H 4 over H 3 : $p > .999$

PROBABILITY OF LATER FORMS CONDITIONAL ON PROBABILITY OF EARLIER FORMS*

1 Probability of Trimester II forms conditional on probability of Trimester I forms

		TRIMESTER II		
		Agonistic	Prosocial	Bimodal
TRIMESTER I	Agonistic	.83	<.001	.17
	Prosocial	.37	.21	.43
	Neutral	.59	.06	.34

2 Probability of Trimester III forms conditional on probability of Trimester II forms

		TRIMESTER III		
		Agonistic	Neutral	Bimodal
TRIMESTER II	Agonistic	.55	.37	.09
	Prosocial	<.001	<.001	.99
	Bimodal	<.001	.66	.34

3 Probability of Trimester III forms conditional on probability of Trimester I forms

		TRIMESTER III		
		Agonistic	Neutral	Bimodal
TRIMESTER I	Agonistic	.52	<.001	.48
	Prosocial	<.001	.79	.21
	Neutral	.46	.28	.26

* Maximum likelihood estimates of probabilities generated under the saturated model

Pearson r's among indices of "proneness to a particular form": inter-relationships within and between Trimesters. *

		Trimester I			Trimester II			Trimester III		
		Agonistic	Prosocial	Neutral	Agonistic	Prosocial	Bimodal	Agonistic	Neutral	Bimodal
	Agonistic									
Trimester I	Prosocial	-.80								
	Neutral	.06	.30							
	Agonistic	.49	.26	-.33						
Trimester II	Prosocial	-.28	-.14	.31	-.76					
	Bimodal	.13	-.07	-.04	-.77	.71				
	Agonistic	.02	.03	.22	.55	-.32	-.60			
Trimester III	Neutral	-.36	.58	.08	.34	-.02	-.40	.13		
	Bimodal	.08	-.23	-.20	-.67	.42	.72	-.79	-.56	

* indexed by the natural log of the ratio of the probability that a response vector conforms to the prototype configuration, to the probability of the configuration's utilization in the sample